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Harm or asset? Investigating the impact of commuting time on life satisfaction in Ústí nad Labem, Czech Republic

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ABSTRACT: This study investigates the impact of commuting on life satisfaction of inhabitants of Ústí nad Labem, Czech Republic. The sample is based on three consecutive questionnaire surveys in years 2019, 2020 and 2021, n = 1686 (893 women). The data was analyzed using ordered logit regression models. The results show that in the case of women, there is an optimal commuting time when using public transport. Also, active commuting (on foot or riding a bike) has a potential positive influence on women's life satisfaction. Commuting by car has no influence on the life satisfaction of women. In the case of men, there is no relation between commuting time and life satisfaction whatsoever. These results can serve as an incentive to promote certain types of transportation both on personal and public level.

KEYWORDS: Commuting, life satisfaction, happiness, students

1. INTRODUCTION

This study investigates the impact of commuting on life satisfaction. It does so on a sample consisting of 1686 inhabitants of the city Ústí nad Labem which is situated in the Czech Republic. The research took place in three consecutive questionnaire surveys during the years 2019, 2020 and 2021.

In a modern society, daily commuting has become a necessary part of the lives of most people. Many people spend up to one or two hours on daily commuting. Therefore, it is of great importance to investigate the effect of commuting on peoples' lives. This has of course been done in past research (Diener et al., 2009). Much research has shown that the impact of commuting on peoples' lives can differ across modes of transportation (St-Louis et al., 2014) or social groups (Janáček and Rybáček, 2020). Thus, we decided to conduct complex research investigating six different modes of transportation (bus, train, car, motorbike, bicycle and walking) in the city of Ústí nad Labem, Czech Republic, where no such research has been conducted yet.

In general, the negative influence of commuting on well-being has been found in many studies (Diener et al., 2009; Janáček and Rybáček, 2020). In accordance with this notion is the study of Frey and Stutzer (2010) who found out that life satisfaction decreases along with the growing distance a person has to commute. There are two reasons why this negative influence applies: firstly, commuting takes away peoples' time which could otherwise be used for other activities and thus reduces resources which could be used to enhance peoples' well-being (Astin, 1984; Chickering and Astin, 1974); Hilbrecht et al., 2014). The second negative aspect of commuting is the fact that the travelling experience itself can be unpleasant and thus decrease peoples' sense of happiness as has been described by Frey (2008).

Commuting can have a negative effect not only on happiness but also on physical health as found by Hoehner et al. (2012) who found that people who spend a lot of time driving are more likely to suffer from metabolic or cardiovascular diseases. The negative effect of commuting on health has also been confirmed by Hansson et al. (2011).

On the other hand, there is substantial evidence that trips to work or school can be pleasant as well, especially if commuting in an active way, i.e. by bicycle or walking (Legrain et al., 2015); Sun et al., 2015). Commuting can be beneficial even when using a car or public transport. Ettema et al. (2012) argue that commuting can serve as relaxation time between work and free time activities and that one of the most positive aspects of commuting can be social interaction. Redmond and Mokhtarian (2001) investigated peoples' preferred length of commuting time and found out that the average commuting time which people would prefer is 16 minutes (one way).

Further, many studies found no relation between commuting and happiness (Biddix, 2015); Chatterjee et al., 2017). The aforementioned studies do not provide a uniform conclusion regarding the impact of commuting on life satisfaction and thus support our claim that investigating this aspect in a different social environment can bring new insight into the topic.

Another factor which should be taken into account when exploring the different aspects of commuting should be the mode of transportation. Martin et al. (2014) found that people who walk to their work or ride a bike are happier than those who drive or use public transportation. In general, driving one's own car turns out to be the worst mode of transportation. Similarly, Fordham et al. (2017) explored how different means of transportation effect the life satisfaction of students in Canada and research of such type was also conducted by St-Louis et al. (2014). All of these studies found that the different modes of transportation affect peoples' happiness differently.

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Variable	Description	Scale
Commuting Time	The duration of the commute to place of work or to school (sum of times there and back)	Integer
Mode of Transportation	Mode of transportation used to commute: 1 – Bus, 2 – Train, 3 – Car, 4 – Motorbike, 5 – Bicycle, 6 – I walk	1 – 6
Life Satisfaction	Satisfaction with the quality of one's current life (question: "how satisfied are you with the quality of your life on a scale of 0-10 where 0 is the worst quality and 10 is the best quality?")	0 – 10: 0 – least satisfied, 1 – most satisfied
Alcohol	Alcohol units consumed per week (1 alcohol unit represents 0.5 liter of beer or 2 dcl of wine or one "shot" of some stronger type of alcohol)	Integer
Sport Time	Number of hours spent doing sport activities per week	Integer
TV Time	Number of hours spent watching TV per week	Integer
Friends Time	Number of hours spent with friends per week	Integer
Marital Status	Current marital status: 1 – Single (no partner, not married), 2 – Has partner, not married, 3 – Married	1 – 3
Education	Highest education level achieved: 1 – Elementary, 2 – High school, 3 – University	1 – 3
Has Children	Dummy variable: 0 – No children, 1 – Has child or children	0/1
Salary	Monthly salary	Integer - CZK
Transfers	Monthly transfers: pension, social support, pocket money, rent	Integer - CZK
Employment Status	Current work status: 1 – Student, 2 – Employed, 3 – Unemployed, 4 - Retired	1 – 4
Age	Age of the person	Integer
Gender	Gender of the person	Male/Female

Table 1. List of variables with their description and scales.

Based on previous research, we expect that the effect of the different modes of transportation have a different impact on peoples' life satisfaction. Thus, we decided to conduct quite complex research investigating six different modes of transportation (bus, train, car, motorbike, bicycle and walking) in the city of Ústí nad Labem, Czech Republic, where no such research has been conducted yet. Specifically, we expect that commuting by bus, train, car or motorbike has a negative influence on life satisfaction, while commuting by bicycle and walking to work or school has a positive influence on peoples' life satisfaction.

2. METHODOLOGY

2.1. Dataset

Our dataset is based on three consecutive questionnaire surveys conducted during the year 2019 (n_1=701), 2020 (n_2=517) and 2021 (n_3=468) in the city of Ústí nad Labem, Czech Republic. Each year the survey took place in October in 5 different locations within the city. Our sample is not a random selection from all inhabitants of the city; although, collection of the data in different locations allows for certain generalizations of our sample to apply to the whole population of the city. The response rate of the people addressed on the street was 63%.

The questionnaire consisted of various questions addressing different aspects of peoples' lives. These questions were selected in such way to enable us to investigate the different areas of lives of the respondents including socio-economic and demographic facts. The aim of the study is to investigate the impact of commuting on life satisfaction but in order to conduct a reliable regression analysis, we also needed to include factors which can also have an influence on one's life satisfaction. The list of all variables obtained from the questionnaire survey is shown in Table 1.

The most important variables for our study are Commuting Time and Mode of Transportation. We included not only Commuting Time as a variable to study but also mode of transportation because it has been shown that different modes of transportation may affect people differently (St-Louis et al., 2014); Whalen et al., 2013). Specifically, we investigate commuting by bus, train (public transportation), car, motorbike (individual motorized way of travelling), bicycle and walking (active modes of travelling).

To measure life satisfaction of the respondents,[1] we follow the method used by the annual World Happiness Report (Helliwell et al., 2020, 2021). In this concept, life satisfaction (happiness) is measured on a scale of 0 to 10 where 0 is the lowest level and 10 is the highest level of happiness. There are other ways of measuring happiness, such as the Oxford Happiness Questionnaire (Abedini and Majareh, 2015). Such more detailed measures based on more than one question undoubtedly offer more insight into the psychological state of the individual. On the other hand, Fordyce (1988) showed that various measures of happiness correlate with each other, meaning that using simpler methods of measuring happiness will give similar results. Since our questionnaire already included many questions, we followed the methodology of World Happiness Report (Helliwell et al., 2020) to achieve reasonable level of simplicity.

In the case of the variables Marital Status, Education and Employment Status, the corresponding dummy variables were created with the reference level being single in the case of Marital Status, not having a university degree in the case of education and being a student in the case of employment status.

2.2. Statistical analysis

We investigate the effect of commuting on life satisfaction using ordered logistic regression models. This is because the dependent variable Life Satisfaction is discrete, measured on a scale 0-10. We analyze men and women separately because it has been shown that the influence of commuting time on life satisfaction can differ across genders (Janáček and Rybáček, 2020).

As for the variables concerning commuting in regression models, we combined the use of cars with the use of mo-

1 Although in many scientific disciplines the terms happiness and life satisfaction are separate, we follow the approach of the economics of happiness and use these terms as synonymous. For further discussion see, Frey (2008).

Variable	Men, n = 791			Women, n = 893		
	Mean	Median	S.D.	Mean	Median	S.D.
Commuting Time	40.5	30	41.6	35.4	20	36.3
Life Satisfaction	7.41	8	1.96	7.54	8	1.85
Alcohol	5.55	3	8.27	2.88	1	5.02
Sport Time	4.89	3	5.76	3.8	2	4.92
TV Time	10.5	8	12.1	11.2	8	11.6
Friends Time	13	10	13	12	10	11.6
Marital St 1	0.364	0	0.481	0.323	0	0.468
Marital St 2	0.343	0	0.475	0.354	0	0.478
Marital St 3	0.293	0	0.456	0.324	0	0.468
Educ Elementary	0.172	0	0.378	0.179	0	0.384
Educ High School	0.681	1	0.466	0.613	1	0.487
Educ University	0.145	0	0.353	0.207	0	0.406
Has Children	0.459	0	0.499	0.557	1	0.497
Salary	1.70E+04	1.70E+04	2.01E+04	1.29E+04	8.00E+03	1.93E+04
Transfers	3.68E+03	0	5.93E+03	4.34E+03	450	6.05E+03
Employment St 1	0.305	0	0.461	0.299	0	0.458
Employment St 2	0.53	1	0.499	0.469	0	0.499
Employment St 3	0.0468	0	0.211	0.0515	0	0.221
Employment St 4	0.11	0	0.313	0.175	0	0.38
Age	35.5	31.5	17	37.3	32	18.8

Table 2. Descriptive statistics, men and women.

torbikes because only 11 men and 4 women in our sample commute daily using motorcycles. We denoted this group of means of transportation as "Individual Motorized vehicles". Analogically, we combined the use of bicycles and walking as it is expected that the effect of using these ways of commuting will be the same as was found by Martin et al. (2014). We denoted this group as "Active commuting".

When constructing regression models, we first created dummy variables for each mode of transportation or group of means of transportation: Bus, Train, Motorized, Active. Consequently, we created interacting variables "Commuting Time*Mode of transportation": CT*Bus, CT*Train, CT*Motorized, CT*Active. This way we can investigate the effect of commuting time for each group of means of transportation.

In our regression models, we included the aforementioned interacting variables both in linear form and in quadratic form (denoted by "sq") because it is possible that in some cases commuting time can increase life satisfaction until a certain time point is reached and then decrease it creating an optimal commuting time as suggested by Redmond and Mokhtarian (2001).

Variables Salary and Transfers were used in logarithmic transformation as it was shown that the relationship between income and happiness is logarithmic (Kahneman and Deaton, 2010). The variable Age was used both in linear and quadratic form because it is possible that there is a peak age point at which the happiness of people is the highest (Deaton, 2008).

In general, the regression results show relationships and it is difficult to assess whether the relation can be interpreted as direct causal effect. Although, in the case of commuting the situation is rather simpler; as the causal effect "life satisfaction –> commuting time" is unlikely to occur, it is very likely that the causal effect "commuting time –> life satisfaction" applies and thus the regression results can be interpreted in terms of causal effects.

3. Results and discussion

3.1. Descriptive statistics

The first observation that can be drawn from table 2 is that on average men commute 5.1 minutes more than women; the difference is statistically significant.[2] One of the possible explanations is that men use cars more often, as is apparent from table 3. In the study of Janáček and Rybáček (2020), men also reported significantly higher values of commuting time. One of the possible explanations for this phenomenon is that men have higher time estimations as found out by Hanson and Buckworth (2016). Another observation concerning variables which this study focuses on is that women are slightly happier than men. This difference is however not statistically significant.[3]

Table 3 presents frequencies of different modes of transportation for both genders.

Mode of transportation	Men		Women	
	Absolute frequency	Relative frequency	Absolute frequency	Relative frequency
Bus	211	27.69%	315	36.42%
Train	125	16.40%	131	15.14%
Car	259	33.99%	217	25.09%
Motorbike	11	1.44%	4	0.46%
Bicycle	22	2.89%	12	1.39%
Walking	134	17.59%	186	21.50%

Table 3. Modes of transportation, frequencies.

2 Levene's test investigating equality of variances: p-value = 0.065. T-test with equal variances assumed: p-value = 0.007.

3 Levene's test investigating equality of variances: p-value = 0.402. T-test with equal variances assumed: p-value = 0.151.

Variable	Men				Women			
	Coefficient	Std. Err	p-value	s	Coefficient	Std. Err	p-value	s
CTxBus	-0.007	0.005	0.182		0.016	0.006	0.012	**
CTxTrain	-0.002	0.004	0.640		0.011	0.006	0.073	*
CTxIndividual	-0.003	0.005	0.636		-0.006	0.008	0.487	
CTxActive	-0.019	0.013	0.146		0.015	0.009	0.078	*
CTxBus sq	-<0.001	<0.001	0.033	**	-<0.001	<0.001	0.025	**
CTxTrain sq	-<0.001	<0.001	0.931		-<0.001	<0.001	0.157	
CTxIndividual sq	<0.001	<0.001	0.487		<0.001	<0.001	0.246	
CTxActive sq	<0.001	<0.001	0.894		-<0.001	<0.001	0.199	
Physical Health	0.524	0.040	<0.001	***	0.550	0.038	<0.001	***
Cigarettes	-0.018	0.010	0.076	*	-0.031	0.012	0.008	***
Alcohol	-0.003	0.009	0.690		-0.032	0.014	0.023	**
Sport	0.006	0.013	0.624		0.022	0.014	0.109	
Has Children	0.051	0.227	0.822		0.287	0.216	0.185	
Unmarried with partner	0.552	0.162	0.001	***	0.134	0.154	0.386	
Married	0.985	0.217	<0.001	***	0.537	0.186	0.004	***
Education Univ	0.246	0.188	0.191		0.242	0.160	0.131	
Employed	-0.359	0.240	0.136		0.092	0.246	0.707	
Unemployed	-0.359	0.382	0.348		-0.320	0.361	0.375	
Retired	0.816	0.539	0.130		0.271	0.438	0.537	
Age	-0.030	0.037	0.413		-0.017	0.031	0.580	
Age sq	<0.001	<0.001	0.791		<0.001	<0.001	0.526	
Salary log	0.021	0.031	0.489		-0.022	0.024	0.361	
Transfers log	0.010	0.024	0.676		0.034	0.024	0.159	
Year 2020	0.152	0.161	0.345		0.115	0.145	0.426	
Year 2021	-0.010	0.160	0.953		0.034	0.158	0.828	

Table 4. Regression analysis output. Dependent variable Life Satisfaction.

Men from Ústí nad Labem use cars and motorbikes more often. They also use bicycles relatively more often which corresponds to the study of Buehler et al. (2020). Women use buses more often. Trains are used by both genders almost equally and the same applies for walking which also corresponds to Buehler et al. (2020).

3.2. Regression analysis

To find out whether commuting time and the mode of transportation is a significant factor of life satisfaction, we constructed two ordinal logit regression models; one for men and one for women. The output of the models is presented in table 4.

Firstly, our models show no relationship between commuting using individual motorized vehicles (cars or motorbikes) and life satisfaction. Neither the linear form of the independent variable nor the quadratic form are significant. This applies for both genders. Our results correspond to the study of Biddix (2015). Apparently using one's own vehicle is not as unpleasant as could be expected.

Concerning commuting by train, there is no relationship between commuting time by train and life satisfaction. Only in the case of women the linear coefficient has a p-value 0.073 and thus exhibits a potential positive (positive coefficient) influence on life satisfaction. It could be that women show a higher inclination to interact socially on trains and thus can enjoy the time travelling by train more than men. This positive aspect of commuting was highlighted by Ettema et al. (2012).

As for travelling by bus, in the case of men the linear variable is not significant and the quadratic variable is significant with a negative coefficient. This means that for short distances commuting effects the life satisfaction of men very little but long distances have a quite negative effect on men's happiness. This corresponds to the findings of Ettema et al. (2012) who emphasized the potential positive effect of short commutes.

Both linear and quadratic variables for commuting by bus for women are significant. The linear coefficient is positive and the quadratic coefficient is negative meaning that life satisfaction as a function of commuting has a maximum at a certain time point, 62.2 minutes in this case.[4] Taking into consideration that in our study the commuting time is measured as a two-way trip, this means that when one-way commuting time by bus is around 31 minutes the happiness of women is maximized. For shorter or longer commutes by bus, happiness declines. Thus, our study corresponds with the findings of Redmond and Mokhtarian (2001); although, in their case the ideal one-way commuting time was only 16 minutes.

Lastly, commuting in an active way (bicycle or walking) shows no relationship with happiness in the case of men and a potential positive relationship with happiness in the case of women (p-value = 0.078 for the linear variable). If walking or riding a bike to work really has a positive influence on women, it is not certain why it is not the case for men. Abasahl et al. (2018) describe various reasons why women tend to choose cycling less often. Thus, one would assume that women's experiential gain will be lower. On the other hand, Dean et al.

4 This is the maximum of the function 0.0157802x - 0.000115653x2, which is at x = 62.2.

(2018) found that nature-relatedness is connected with better health and more importantly it is higher in females. Here, nature-relatedness means being able to connect with nature and enjoy its benefits. Since respondents in our sample can be expected to commute to work at least partly through green spaces, the results of the study of Dean et al. (2018) might be the reason why women take greater benefit from commutes. Further, Clifton and Livi (2005) observed differences in perception across genders when walking. This is supported by Song et al. (2019) who have shown that walking in nature has a positive effect on women. Even if some respondents do not necessarily commute through green spaces, the study of Clifton and Livi (2005) shows that women perceive their environment differently and thus the effect of active commuting might indeed be different across genders.

4. CONCLUSION

Our study has shown the different effects of commuting for various modes of transportation. Commuting by car or motorbike has no effect on life satisfaction for both genders. Commuting by train has no effect on life satisfaction in the case of men and a potential positive effect in the case of women. Commuting by bus has a negative effect on life satisfaction for long distances in the case of men. In the case of women, there is an optimal commuting time by train (31 minutes one-way). As for riding a bike or walking, this has no effect on the life satisfaction of men and a potential positive effect on the life satisfaction of women.

Our results clearly show that different modes of transportation influence people differently. Further, the effect of commuting is different for men and for women. Considering the large number of studies showing the negative effect of commuting on life satisfaction, our results may be regarded as significant. The only mode of transportation which shows a negative effect on happiness is travelling by bus. It is highly probable that differences in results across different studies are based on the quality of transportation in different areas. For example, in the region in which our study was conducted, trains are of good quality and are regarded as a comfortable means of transportation. Our results correspond to this fact.

The apparent recommendation which can be deduced from our results is that active commuting (riding a bike or walking) should be preferred before using public transportation (in this case buses). Our results clearly show that buses have the potential to decrease one's happiness significantly. Using a car or a motorbike seems to be a safer way to travel but given the air pollution in the cities connected to this mode of transportation, it would be rather awkward to recommend this type of transportation.

Our study depicts the role of different modes of transportation in the lives of the inhabitants of the city Ústí nad Labem. Since the results are different from the results of studies conducted in other parts of the world, it appears that the effect of commuting and transportation in general on life satisfaction depends on many variables which vary across different regions. If one wants to study the role of transportation in specific area for any reason, conducting a study such as ours seems like a useful tool.

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